

Translation

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P802653/WO/1	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/EP2004/008137	International filing date (day/month/year) 21.07.2004	Priority date (day/month/year) 30.07.2003
International Patent Classification (IPC) or national classification and IPC C23C4/12, C23C4/08, F02F1/00, F01L3/02, B23K35/40		
Applicant DAIMLERCHRYSLER AG		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 10 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

a. ☒ (sent to the applicant and to the International Bureau) a total of 4 sheets, as follows:

☒ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

b. ☐ (sent to the International Bureau only) a total of _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

<input checked="" type="checkbox"/>	Box No. I	Basis of the report
<input type="checkbox"/>	Box No. II	Priority
<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input type="checkbox"/>	Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/>	Box No. VI	Certain documents cited
<input type="checkbox"/>	Box No. VII	Certain defects in the international application
<input checked="" type="checkbox"/>	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
Name and mailing address of the IPEA/EP	Authorized officer
Facsimile No.	Telephone No.

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Box No. I

Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
 - ☐ This report is based on translations from the original language into the following language _____ which is the language of a translation furnished for the purposes of:
 - ☐ international search (Rule 12.3 and 23.1(b))
 - ☐ publication of the international application (Rule 12.4)
 - ☐ international preliminary examination (Rule 55.2 and/or 55.3)
2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
 - ☐ the international application as originally filed/furnished
 - ☒ the description:
 - pages 1-10 _____ as originally filed/furnished
 - pages* _____ received by this Authority on _____
 - pages* _____ received by this Authority on _____
 - ☒ the claims:
 - nos. _____ as originally filed/furnished
 - nos.* _____ as amended (together with any statement) under Article 19
 - nos.* 1-15 received by this Authority on 27.06.2005 with letter of 23.06.2005
 - nos.* _____ received by this Authority on _____
 - ☒ the drawings:
 - sheets 1/1 _____ as originally filed/furnished
 - sheets* _____ received by this Authority on _____
 - sheets* _____ received by this Authority on _____
 - ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.
3. ☐ The amendments have resulted in the cancellation of:
 - ☐ the description, pages _____
 - ☐ the claims, nos. _____
 - ☐ the drawings, sheets/figs _____
 - ☐ the sequence listing (*specify*): _____
 - ☐ any table(s) related to sequence listing (*specify*): _____
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
 - ☐ the description, pages _____
 - ☐ the claims, nos. _____
 - ☐ the drawings, sheets/figs _____
 - ☐ the sequence listing (*specify*): _____
 - ☐ any table(s) related to sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-15	YES
	Claims		NO
Inventive step (IS)	Claims	10	YES
	Claims	1-9, 11-15	NO
Industrial applicability (IA)	Claims	1-15	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

1. Preliminary observation

Claim 1 is now restricted to a product that is characterised in that a valve seat ring is formed by the deposition of a Co or a Co/Mo alloy as a homogenous layer, using an electric arc wire spraying process. Similar methods are claimed in claims 9 and 10. According to the present claims, there is unity of invention.

2. Reference is made to the following documents:

D1: EP-A-0 338 204 (THOMPSON GMBH TRW)
25 October 1989 (1989-10-25)

D2: EP-A-1 172 452 (WINSERT INC)
16 January 2002 (2002-01-16)

D3: EP-A-0 227 634 (VER EDELSTAHLWERKE AG)
1 July 1987 (1987-07-01)

D4: DE 198 41 618 A (DAIMLER CHRYSLER AG)
30 March 2000 (2000-03-30)

D5: POPOOLA O O ET AL: "Novel powertrain applications of thermal spray coatings",
SURFACE ENGINEERING, THE INSTITUTE OF

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MATERIALS, LONDON, GB, vol.14, no. 2, 1998,
pages 107-112, XP009038643

D6: EP-A-0 927 816 (FORD GLOBAL TECH INC)
7 July 1999 (1999-07-07)

D7*: JP-A-1-138 095 & PAJ, abstract in English.

*) introduced by the examiner during the
substantive examination proceedings.

3. D5 is considered to be the prior art closest to the present claims. Said document (see page 110, right-hand column, second paragraph) refers to valve seat coatings that are applied directly ("overlay or clad") to aluminium cylinder heads ("AI engine heads"). By comparison with conventionally injected valve seats, the method is simplified in this way and heat transfer improved. Laser surface welding "laser cladding"), electrowelding methods, friction welding and thermal spraying methods are cited as being suitable. Thermal spraying is mentioned as being advantageous since, with carefully selected alloy wires or powders, unique alloys can be produced. An electric arc spraying system with two wires, made of high-carbon steel and a nickel alloy respectively, is given as a typical example, a corrosion resistant valve seat made of an Fe-Fe₃O₄/Ni-NiO-CrO composite material being produced therewith.

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- 3.1 Thus, claims 1 and 9 of the present application differ from the disclosures of D5 by virtue of the use of a Co or a Co/Mo-based alloy with $\text{Mo}+\text{Co}>50 \text{ wt.}\%$ and $\text{Fe}>5 \text{ wt.}\%$. In addition, the layer-thickness is between 0.1 and 2 mm.
- 3.2 However, no inventive contribution is evident in the aforementioned features, the thickness of the respective layers appearing to be within the usual range for valve seat rings. This impression is reinforced by the lack of clarity cited in point 1. of Box VIII below. Moreover, D5 (see the paragraph cited above) refers explicitly to the fact that, dependent upon the intended application in each case, a large number of other alloys are commonly used for valve seat rings, including *inter alia* cobalt alloys for high performance engines. Alloys as per claims 1 and 9 are known, for example, from D1, D2 or D7.
- 3.3 D1 discloses, *inter alia*, cobalt-based alloys for coating machine components that are subject to high thermal stresses, valve seats in combustion engines being mentioned specifically. The alloys can be applied by autogenous methods as well as by plasma-powder surface welding methods. *Inter alia*, conventional mechanically resistant alloys of the Stellite® type are given in table 1, these having a Co or a Co+Mo content of greater than 50 mass %, an Fe content of less than 5 mass %

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and a Cr content of between 5 and 30 mass %.

Document D1 (see claims 3-6 and claim 9) claims alloys which are of a similar composition and, in addition, contain between 0.105 and 0.8 mass % of nitrogen.

3.4 D2 discloses Co-rich and Mo-rich alloys that are suitable for valve seats in combustion engines (see paragraph [0001] in combination with page 5, table 1, alloys 34-37).

3.5 D7 discloses flexible composite wires made of Stellite® or Tribaloy® for the deposition of hard surfaces. Table 1 shows the use of Stellite® 1, Stellite® 6 and Tribaloy® T800, each containing < 5 wt.% of Fe and > 50 wt.% of Co. In D7, the proportion of cobalt is substantially within the matrix.

3.6 The subject matter of claims 2-8 and claims 11-15, in so far as they refer back to claim 9, relate to preferred embodiments of the 'obvious' claims 1 and 9, said embodiments also being known from either D1, D2, D5 or D7 or being a routine technical practice and, thus, said claims are not inventive either.

4. The remaining documents cited in the international search report are less closely related than D1, D2, D5 or D7 to the subject matter of the present claims.

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- 4.1 D3 discloses a welding wire that is suitable for the hard-facing of valve seats. According to example 2, an alloy is sprayed, said alloy being composed of (proportions given in wt.%) 1.15 C, 0.6 Si, 0.5 Mn, 27.5 Cr, 4.7 W, 5 Fe and residual cobalt with argon as an inert gas, the maximum grain size being 300 μm . The diagram in figure 1 represents a device in which a nickel-iron pipe that is filled with this powder, said pipe have a diameter 5.5. mm and the pipe wall being 1mm thick, is twice subjected to traction, it being possible to reduce the diameter thereof to 1.6 mm and the thickness of the wall to 0.3 mm.
- 4.2 D4, filed by the present applicant, discloses a method for the production of a thermally sprayed, abrasion-resistant smooth-acting synchronising coating on a synchronising ring. A wire electric arc spraying method is used, the use of a filler wire as the spraying compound being a particularly preferred embodiment. The filling of the filler wire contains titanium dioxide in addition to tin, zinc, copper and aluminium and, in consequence, the coating produced contains at least 40 wt.% of titanium dioxide. The outer sheath of the filler wire is preferably made of copper or aluminium. A further preferred embodiment relates to the use, in combination, of a filler wire and a solid wire, preferably made of a copper-aluminium alloy (see the search report for source references).

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4.3 D6 discloses the production of valve seat inserts for cylinder heads, using electric arc wire spraying methods, *inter alia* with two different wires. For example, a carbon-rich steel is used, said steel containing (proportions in wt.%) 1.0 C, 1.6 to 2.0 Cr, 1.6 to 1.9 Mn, residual iron and a nickel alloy with 58 Ni, 4 Nb, 10 Mo, 23 Cr and 5 Fe), air or nitrogen being used as a carrier gas (see the search report for source references). The density of the layer is at least 99% and it can consequently be considered to be "homogenous" in the sense according to the present application. The layer is sprayed onto a cylinder, sliced into separate rings and used in the end product, namely in the cylinder head (see D6, claims 1-3).

5. In the light of the above observations, claims 1-9 and 11-15 do not involve an inventive step and therefore fail to satisfy the requirements of PCT Article 33(3).

6. None of the available documents discloses or suggests an alternative method for the production of thermally sprayed valve seat rings using electric arc spraying with a filler wire, as per claim 10 of the application, the essential proportion of Co being supplied from the casing of the filler wire.

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6.1 On the assumption that claim 10 is intended to relate to the application of the valve seat ring to the base metal of a cylinder head (see comments relating to clarity in Box VIII, paragraph 2), the subject matter of claim 10 appears to be novel and inventive and, in consequence, to satisfy all the requirements of PCT Article 33. The same would apply to dependent claims 11-15 in so far as they refer back only to claim 10.

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Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

1. In a preferred embodiment according to dependent claim 7, the claimed thickness of the sprayed layer is between 0.1 and 2 mm thick whilst a preceding claim, claim 1, already contains this restriction. Doubt is therefore cast upon the essential character of said restriction, giving rise to a lack of clarity in relation to the scope of protection sought in claim 1 and also, therefore, in claim 9.
2. The subject matter of claim 10 does not contain all the essential features. "The base metal" is introduced with a definite article but without a point of reference. The method is not restricted to deposition onto the base metal of a cylinder head. Since said claim, in its present form, does not exclude conventional methods in which the alloy material for the valve seat rings is deposited onto a cylinder, it goes beyond the disclosure according to the description.
3. Claims 1, 9 and 10 therefore fail to satisfy the requirements of PCT Article 6.